Power filed on August 23, 2002, be acknowledged by the Examiner. Applicants further request that, in accordance with the Associate Power filed on August 23, 2002, the Patent Office records be changed to reflect that all future correspondence regarding this matter be mailed to the following:

Karen A. Lowney
Estee Lauder Companies
125 Pinelawn Road
Melville, NY 11747

Summary

This is in response to an Office Action dated May 14, 2003. Claims 1-17 are pending in the application. Claims 11 and 13-17 stand withdrawn from consideration by the examiner as being drawn to a non-elected invention. Claims 1-10 and 12 stand rejected. The Office Action was made Final.

Reconsideration based on the following amendments and remarks is respectfully requested.

Election/Restrictions

Applicant acknowledges the withdrawal of claims 11 and 13-17 as being drawn to a non-elected invention but reserves the right to pursue the withdrawn claims in a divisional application.

Claim Rejections - 35 U.S.C. 112

Claim 10 stands rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. According to the Office Action, the claim scope is uncertain because the use of the trade name "Surlyn" cannot be used properly to identify any particular material or product.

Claim 10 has been amended to more clearly define the invention. The trade name Surlyn has been removed and replaced with "a molding resin selected from a thermoplastic resin and a thermoset resin". Support for the amendment is found in the specification in the first full paragraph on page 9 (paragraph 0029 in Publ. No.: US 2002/0175136 A1). It is respectfully submitted that by this amendment the rejection of claim 10 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to

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particularly point out and distinctly claim the subject matter which applicant regards as the invention has been overcome. Reconsideration is respectfully requested.

Claim Rejections - 35 U.S.C. 102, or alternatively 35 U.S.C. 102(b)

In the present Office Action, claims 1, 2, 4, 5 and 7-9 stand rejected under 35 U.S.C. 102(b) as being anticipated by Barriere (3,663,259), or in the alternative, under 35 U.S.C. 103(a) as being unpatentable over Barriere in view of Nohara (4,646,925).

With respect the the rejection under 35 U.S.C. 102(b) as being anticipated by Barriere, according to the Office Action, the Barriere reference teaches a container having a first thin-walled bottle with a neck 2 extending from a storage portion, and a minimum wall thickness, a resin body 5 having a maximum wall thickness at least three times the minimum wall thickness of the storage portion.

Claim 1 has been amended to recite an *injection molded* resin body over-molded about the first bottle such that at least the opening in the distal end of the neck is exposed. Support for these amendments can be found in the specification (last paragraph on page 5 and last paragraph on page 7 in the specification as filed; alternatively, paragraphs 0020 and 0029 in Publ. No.: US 2002/0175136 A1). For at least the following reasons, it is respectfully submitted that the amendments overcome the rejection.

A rejection under 35 U.S.C. 102(b) requires that each element of a pending claim be disclosed in a single prior art reference. The Barriere reference fails to teach (or suggest) an injection molded resin body over-molded about the bottle. At best the Barriere reference teaches coating by dipping or casting in a liquid polyester resin (the state of the art for polyester resins at the time of the Barriere invention). There is nothing in the Barriere reference that teaches a resin body injection overmolded on a thin-walled bottle.

Because Barriere does not teach a resin body injection over-molded about a thin-walled bottle, Barriere does not teach each element of claim 1. The present invention as recited in claim 1 therefore distinguishes from and is patentable over the Barriere reference. Thus, with respect to claim 1 as amended, and claims 2, 4, 5 and 7-9 (which depend from and include all of the recitations of claim1), the rejection under 35 U.S.C. 102(b) as being anticipated by Barriere (3,663,259) is traversed and should be withdrawn.

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Claims 1, 2, 4, 5 and 7-9 stand rejected, in the alternative, under 35 U.S.C. 103(a) as being unpatentable over Barriere in view of Nohara (4,646,925). According to the Office Action, Nohara teaches that it is known in the art to provide the outer resin outer body [sic] by injection molding as shown in Fig. 5. The Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide the outer body by injection molding in Barriere as taught by Nohara to provide an alternative method of making the outer layer.

Applicants respectfully disagree for at least the following reasons.

Combining the teachings of two references requires at least a suggestion that would motivate one make the combination. This is generally understood to be at least a suggestion that the combined teachings of the two references would yield a benefit or an advantage. The Examiner did not assert such a benefit or advantage, and there is in fact no benefit or advantage taught or suggested in either reference that would motivate one to combine the teachings of the two references. The two references in fact address different art areas. Barriere discloses coating a fully formed bottle. Nohara discloses injection over-molding to make a multilayer **pre-form** for the eventual production of a bottle by draw-blow forming. Thus, Nohara teaches injection over-molding of a pre-form of a bottle, not injection over-molding a resin body about a bottle. Since there is no suggestion in either reference that a benefit or advantage would be yielded by combining the references, there would be no motivation to combine these references. Because there would be no motivation to combine the references, the rejection of the claims based on the combination is not well taken and should be withdrawn.

In the unlikely event that one would be motivated to combine the teachings of the Barriere and Nohara references (as noted above, there would be no motivation to do so), combining the teachings would not yield the present invention as claimed. As noted, Barriere teaches coating a resin onto a bottle. Nohara teaches injection molding a resin outer layer *onto a resin pre-form*. The resulting multi-layer pre-form is subsequently draw-blow formed into a finished bottle. The Barriere reference coats a finished bottle, not a pre-form, and does not teach or suggest subsequent operations, such as draw-blow molding, to form a finished bottle because none are necessary. The coated bottle of Barriere is finished. The resulting products of the two operations are also radically different. The Barriere reference yields a finished glass bottle with a resin coating. The Nohara reference yields a multi-layer pre-form with a

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resin inner layer, a barrier layer and resin outer layer. There is no teaching or suggestion that this multi-layer pre-form or any of its individual layers would be suitable for use in coating a glass bottle. Thus, even if the teachings of Barriere were combined with the teachings of Nohara, one might arrive at injection molding a resin outer layer on a pre-form of a Barriere-like bottle, but one would not arrive at a resin coating on a finished bottle according to Barriere.

Because there would be no motivation to combine the Barriere and Nohara references, and/or because even if the teachings of Barriere and Nohara were combined one would not arrive at the present invention as claimed, the rejection of claims 1, 2, 4, 5 and 7-9, in the alternative, under 35 U.S.C. 103(a) as being unpatentable over Barriere in view of Nohara (4,646,925) is not well taken and should be withdrawn.

Rebuttal of Examiner's Response to Arguments

The Examiner takes the position that the product of the present invention is the same as or obvious from the product disclosed in the Barriere reference. For at least the following reasons, Applicants disagree.

In the Office Action, the Examiner asserts that the patentability of a product does not depend on its method of production. The Examiner goes on to say that if the product in a product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.

While the foregoing assertions may be true, they do not apply to the present application as recited in the amended claims because the claims are not product-by-process claims and/or because the product according to the present invention is not the same as or obvious from the prior product (Barriere). The present claims are not product-by-process claims because it is well known in the art that an injection over-molded component has a different molecular level structure than a caste or dipped component. One of ordinary skill in the art of molding resin components would readily understand the recital of an injection over-molded component to include the structural distinction. The recital in the present claims of injection over-molding is intended to distinguish the injection over-molded resin body structurally from a resin body that is not injection over-molded. In this case, the recital distinguishes the claimed

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invention over the Barriere prior art, i.e., a resin body coated on a component by dipping or casting.

Even if the claims are perceived to be product-by-process claims, the product of the present invention is not the same as the prior art product because the prior art product is coated with a dipped or caste resin. The present invention distinguishes from the prior art with a resin body injection over-molded about the bottle. A resin body injection over-molded about the bottle is structurally different from a resin coating that has been otherwise deposited, such as, for example, a resin coating applied by dipping or casting as in Barriere. For example, it is well known in the art that an injection over-molded component has a different molecular level structure than a caste or dipped component. Thus, one of ordinary skill in the art of molding resin components would readily understand this claim language to include the structural distinction. The recital in the present claims of injection over-molding is intended to distinguish the injection over-molded resin body structurally from a resin body that is not injection over-molded. In this case, the recital distinguishes the claimed invention over the Barriere prior art, i.e., a resin body coated on a component by dipping or casting.

It is also noted that the U.S. Patent Office has recognized such distinctions by granting patent claims with such recitals. For example, in the prior art cited in the present application, Wallace 3,007,594 and Nohara 4,646,925 describe what at first glance could be construed as identical products. Nohara issued almost 30 years after Wallace, yet it includes as a recitation "...portions are integrally formed of a thermoplastic polyester...". While this appears to be product-by-process language, it is more clearly understood by those skilled in the art as structurally distinguishing the component from non-integrally formed components.

The present invention as claimed is not obvious from the Barriere product because, at the time of the Barriere invention, polyester resins and methods for manufacturing articles from such resins were thought to be unsuitable for coating articles by injection molding due to process limitations of injection molding at the time, e.g., high temperature and high pressure. This was particularly a problem with coating of hollow thin-walled glass articles such as bottles, which are fragile and break easily when subjected to heat and/or pressure. Thus, polyester resins were thought to be suitable only for coating such articles by dipping or casting. It would therefore not have been contemplated at the time of the Barriere invention to make a coated article by injection overmolding with polyester resin.

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As noted above, the present claims call for overmolding by injection, which yields a unique product, a bottle enclosed in an injection molded resin body. The Barriere reference does not disclose overmolding by injection, and therefore, the Barriere reference does not disclose the product yielded by the present invention ***and*** does not disclose each of the elements of the present claims. Accordingly, the Barriere reference cannot support a rejection of the present claims under 35 U.S.C. 102(b). For at least the foregoing reasons, it is respectfully submitted that the rejection of claims 1, 2, 4, 5, 7-9 and 12 under 35 U.S.C. 102(b) as being anticipated by Barriere is inappropriate and should be withdrawn.

Claim Rejections - 35 U.S.C. 103

Claims 3, 6, 10 and 12 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Barriere in view of, *respectively*, Frye et al. (4138027), Shaffer (3006780), Richie (3738524) and Reinhard (3870186). In each case, the Office Action asserts that Barriere "meets all claimed limitations except"... with the exception being met by the respective second reference.

As detailed above, Barriere falls short of meeting all claimed limitations. In particular, Barriere, nor any other cited reference, teaches or suggests overmolding a finished bottle by injection. As noted above, overmolding by injection yields a structurally unique resin body that is not disclosed by Barriere or any other cited reference. Furthermore, Barriere, either alone or in combination with any other cited reference, fails to suggest the claimed invention because none of the references teach or suggest that any benefit or advantage would be achieved by injection overmolding the structure of the present invention. Because Barriere either alone or in combination with the other cited references does not teach or suggest injection overmolding the structure according to the present invention, Barriere fails to meet all of the claim limitations and cannot support the rejection of claims 3, 6, 10 and 12 under 35 U.S.C. 103(a). Accordingly, it is respectfully submitted that the rejection of claims 3, 6, 10 and 12 under 35 U.S.C. 103(a) be withdrawn.

In view of the amendments and remarks above, it is respectfully submitted that the present invention is patentable over the cited prior art. Early and favorable consideration is respectfully requested. Applicants reserve the right to file

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division, continuation and continuation-in-part applications to prosecute any inventions or species.

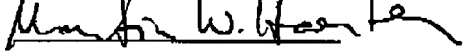
Submitted concurrently herewith is a Petition for Extension of Time to extend the time to respond by three months from August 14, 2003 to November 14, 2003. The Petition includes authorization for the Commissioner to charge the fee for extension to Deposit Account No. 05-1320.

Also submitted concurrently herewith is an Information Disclosure Statement By Applicant (1 page) listing two references (US 2,013,382 and US 3,007,594) that may be relevant to this application.

If there are any other issues remaining which the Examiner believes could be resolved through telephone contact, the Examiner is respectfully encouraged to call the undersigned at the telephone number indicated below.

Respectfully submitted,

November 14, 2003



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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	09/863,845
Filing Date	05/23/2001
First Named Inventor	Herve F. BOUIX
Art Unit	3727
Examiner Name	Tri M MAI
Attorney Docket Number	2870/296 (00.12)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
TM		US- 2,013,382	09-03-1935	Garwood	
TM		US- 3,007,594	11-07-1961	Wallace	
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[2]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	TM	Date Considered	1/13/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

Sept. 3, 1935. C. B. GARWOOD 2,013,382

METHOD OF MAKING MULTIPLE BOTTLES

Filed Nov. 4, 1933 2 Sheets-Sheet 1

Fig. 1.

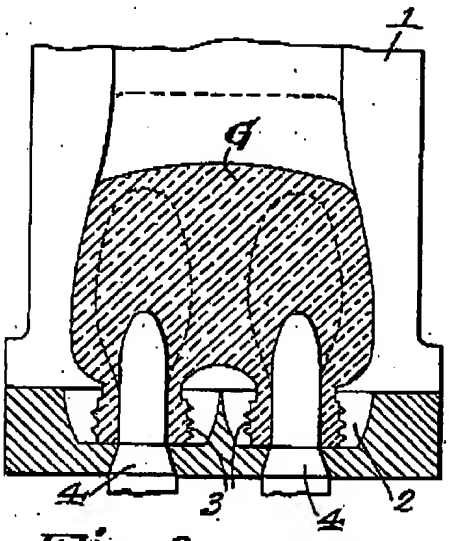


Fig. 2.

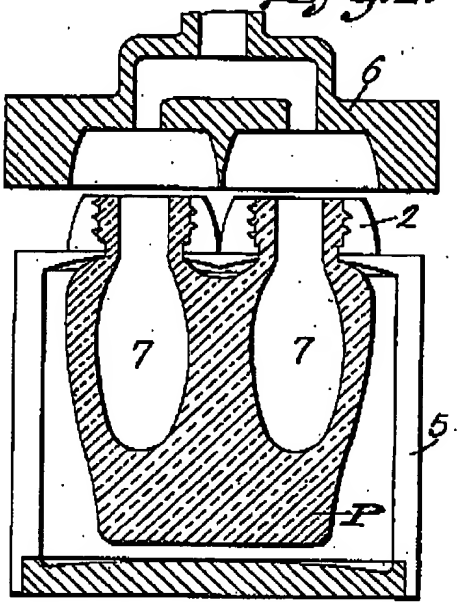


Fig. 3.

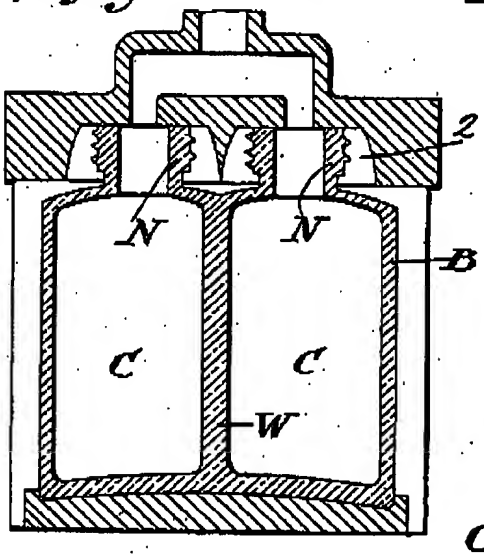
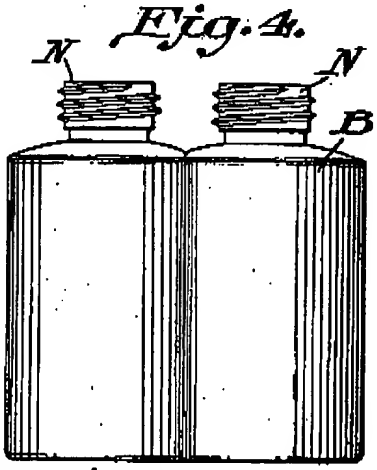


Fig. 4.



C. B. Garwood Inventor

By C. A. Snow & Co.

Attorneys.

Sept. 3, 1935. C. B. GARWOOD 2,013,382

METHOD OF MAKING MULTIPLE BOTTLES

Filed Nov. 4, 1933 2 Sheets-Sheet 2

Fig. 5.

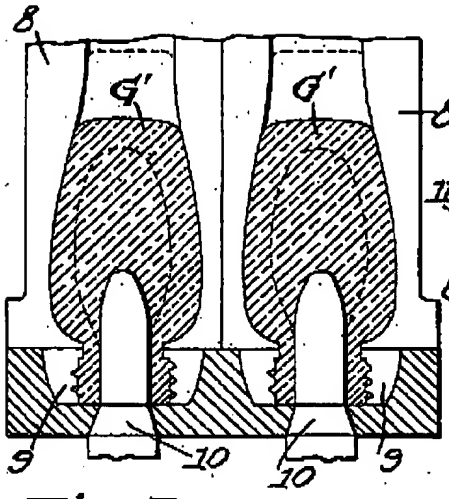


Fig. 6.

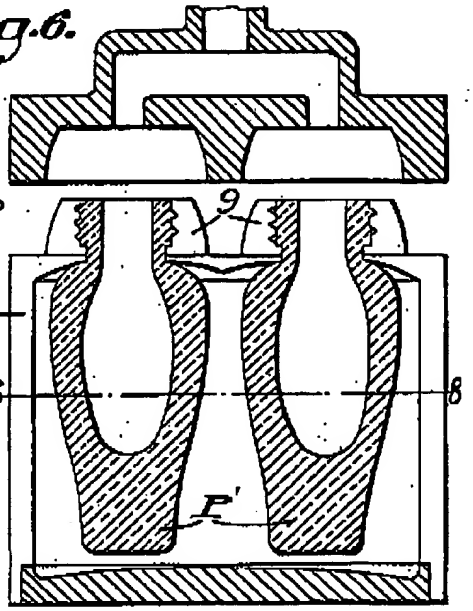


Fig. 7.

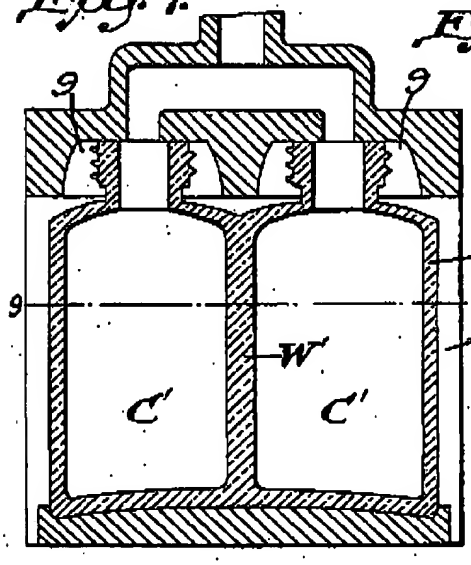


Fig. 8.

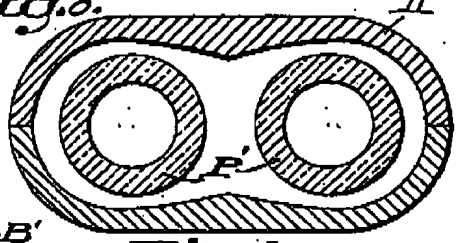
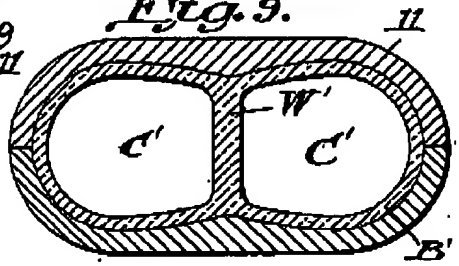


Fig. 9.



C. B. Garwood Inventor

By Cushman & Co.

Attorneys.

Patented Sept. 3, 1935 2,013,382

UNITED STATES PATENT OFFICE

2,013,382

METHOD OF MAKING MULTIPLE BOTTLES

Charles B. Garwood, Baltimore, Md., assignor to Carr-Lowrey Glass Co., Baltimore, Md.

Application November 4, 1933, Serial No. 698,707

4 Claims. (Cl. 49—80)

This invention relates to a new and improved method of producing multiple bottles or bottles having two or more separate compartments with separate closures.

It is the practice, in packaging some kinds of merchandise, to use two or more separate bottles in a single holder for containing different kinds of preparations. For example, ink eradicators have been placed on the market with two different kinds of fluids contained in separate bottles which are sold as a unit. Preparations for the treatment of the finger nails are similarly marketed and the same holds true with various other kinds of products supplied to the public. In all such cases it has been the practice, as before stated, to use separate bottles but this has its disadvantages. Not only does it require special containers for holding the set of bottles while being shipped and while in use, but frequently one bottle of a set will become lost so that the remainder of the merchandise becomes unuseable.

It is an object of the invention to provide a multiple bottle of glass which has separate compartments, the compartments being provided with individual closures which can be separately removed to afford access to the respective compartments.

It is a further object of the invention to provide a multiple compartment bottle molded in a single piece of glass so that when the respective compartments are filled, there is no danger of losing any part of the complete unit.

It is a further object to provide a one-piece multiple compartment bottle which does not require a special container for holding the units assembled and can, therefore, be packed and sold at lower cost than where the merchandise is formed of two or more separate bottles held within a specially constructed container.

The present method of producing a glass container with a single compartment includes the step of drawing glass by vacuum into a blank mold or by feeding a gob into the mold. A neck ring and plunger are fitted to one end of the mold, and the glass is then forced into the neck ring and about the plunger. The neck ring determines the outside size and shape of the neck and the plunger determines the size and shape of the opening in the neck. When the plunger is removed it leaves a recess in the blank into which air is blown to complete the formation of a parison in the blank mold, and subsequently the final expansion of the parison within the blow mold is effected.

In carrying out the present method it is designed to feed the glass to a blank mold by either of the methods stated. The present method differs from former ones, however, in that the blank mold is provided with a neck ring having two or more openings and each opening is provided with the usual plunger so that the resulting parison is made up of a single blank with spaced necks and with a recess extending within each neck. Then after the withdrawal of the plungers and the expansion of the blank, the parison is deposited in a blow mold of proper design to which air is supplied under pressure. The parison is thus expanded to form a single one-piece bottle having separate non-communicating compartments each of which has its own individual neck.

A modification of the method consists in producing separate blanks each with a single neck and recess and then transferring the separate parisons to a blow mold where they are subjected simultaneously to the action of air under pressure. This results in expanding the parisons until their adjoining portions come together and merge to form a partition, the resultant bottle thus being provided with a number of compartments equal to the number of parisons employed and which compartments are separated by the partition. The entire structure becomes unified so as to become a one-piece container, each compartment being formed with its individual neck.

In order that the several steps of the method may be more clearly understood reference is had to the accompanying drawings wherein

Figure 1 is a section through a portion of a blank mold showing by full lines, the partially formed blank extending into a multiple neck ring, and by dotted lines, the completed parison.

Figure 2 is a similar view showing a parison supported within a blow mold, prior to the withdrawal of the neck ring and the application of the blow head.

Figure 3 is a section through the blow mold showing the fully expanded parison therein.

Figure 4 is an elevation of a multi-compartment bottle produced by the method described.

Figure 5 is a view similar to Figure 1 showing separate blank molds.

Figure 6 is a view of a blow mold showing separate parisons suspended therein prior to the application of the blow head.

Figure 7 is a view showing the parisons following the final blowing operation, the said parisons being merged to produce a one-piece container.

Figure 8 is a section on line 8—8, Figure 6.

Figure 9 is a section on line 9—9, Figure 7.

Referring to the figures by characters of reference 1 designates a blank mold of any suitable construction having a neck ring 2 formed with separate openings 3 into which plungers 4 project. Following the formation of a blank from the glass G deposited in the mold 1, the parison is transferred in any manner to a blow mold 5 the blow head 6 of which is so constructed that air under pressure can be directed simultaneously to the respective recesses 7 in the parison T. Thus the parison will be expanded to produce a finished article as shown in Figure 8, and by having recesses 7 of equal sizes and directing into them equal pressure, the separate compartments C formed in the bottle B will be of equal areas and will be separated by an integral partition or dividing wall W.

As shown particularly in Figure 4 the bottle thus produced will have a neck N for each compartment C and these necks can be provided with individual closures so that either compartment can be opened independently of the other.

While the bottle illustrated contains only two compartments it is to be understood that it will be possible to make a multiple bottle with more than two compartments. Such a modified design is so obvious that detailed illustration thereof is not believed necessary.

In Figure 5 two blank molds have been indicated at 8 and each of these is provided with a neck ring 9 and a plunger 10. One neck ring with two or more openings can be used with the two or more blank molds or, under some conditions, each blank mold would have its own neck ring. In carrying out the method it is merely essential that the required number of blanks or parisons be transferred into a single blow mold 11 after which all of the parisons are subjected simultaneously to the action of air under pressure so as to expand them to their proper shapes. The shaping of the parisons in the blow mold will result in bringing them together along their adjoining portions and those parts which come together will become unified and produce a partition or dividing wall W' separating the respective compartments C' in the bottle B'.

Obviously bottles produced by the method described can be made of attractive designs and can be supplied to customers without requiring the use of holders or containers such as heretofore used where two or more bottles have been sold as a unit. By reducing the operations required in the production of the multiple bottle the cost of production is reduced. Furthermore the amount of glass necessary in the production of one multiple bottle is somewhat less than that necessary where single bottles of the same capacity are produced separately. Thus multiple bottles such as described can be supplied to the trade at lower cost than groups of single bottles and a still further saving can be effected by the elimination of special holders such as required where separate bottles are used.

Importance is attached to the fact that the articles covered by this application can be manufactured by the same movements of a bottle making machine as in making an ordinary single bottle.

What is claimed is:

1. The method of producing a multiple compartment container having a separate neck for each compartment, which includes the step of forcing glass into separate neck ring openings to produce a single blank having separate spaced necks projecting therefrom, and separate recesses extending into the respective necks, thereafter shaping the blank into a parison, then transferring the initially shaped parison to a blow mold, and finally directing air under pressure through the separate formed necks into the separate recesses, thereby to give the glass its final shape and form separate compartments in communication with the respective necks.

2. The method of producing a multiple compartment one-piece container having a separate neck for each compartment, which includes the step of forcing a single gob of glass into separate neck ring openings to form a single blank having spaced separate necks each with a recess opening thereinto, thereafter initially blowing the blank to produce a parison, then transferring the initially shaped parison to a blow mold, and finally directing air under pressure simultaneously through all of the formed necks and into all of the recesses thereby to give the glass its final shape and form separate compartments in communication with the respective necks, said compartments being separated by an integral dividing wall.

3. The method of producing a multiple compartment one-piece container having a separate neck for each compartment, which includes the step of forcing a single gob of glass simultaneously into separate neck ring openings, thereby to produce a single blank having separate spaced necks each with a recess extending thereinto, thereafter initially blowing the blank to expand the recesses and produce a parison, then transferring the parison to a blank mold, and finally directing air under pressure through the formed necks and into the respective recesses, thereby to expand the parison to its final shape and form separate compartments in communication with the respective necks, said compartments being separated by an integral dividing wall.

4. The method of producing a multiple compartment one-piece container having a separate neck for each compartment, which includes the step of depositing molten glass in a blank mold and allowing it to flow into position within separate neck ring openings at the bottom of the mold thereby to form a single blank having separate necks each with a recess extending thereinto, thereafter initially blowing the blank to simultaneously enlarge both recesses and produce a parison, then transferring the initially shaped parison to a blow mold, and thereafter directing air under pressure simultaneously through all of the formed necks and into all of the recesses, thereby to give the glass its final shape and form separate non-communicating compartments opening into the respective necks.

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Nov. 7, 1961 R. T. WALLACE 3,007,594

PLASTIC COATED ARTICLES AND METHOD FOR MAKING THE SAME

Filed Aug. 6, 1959

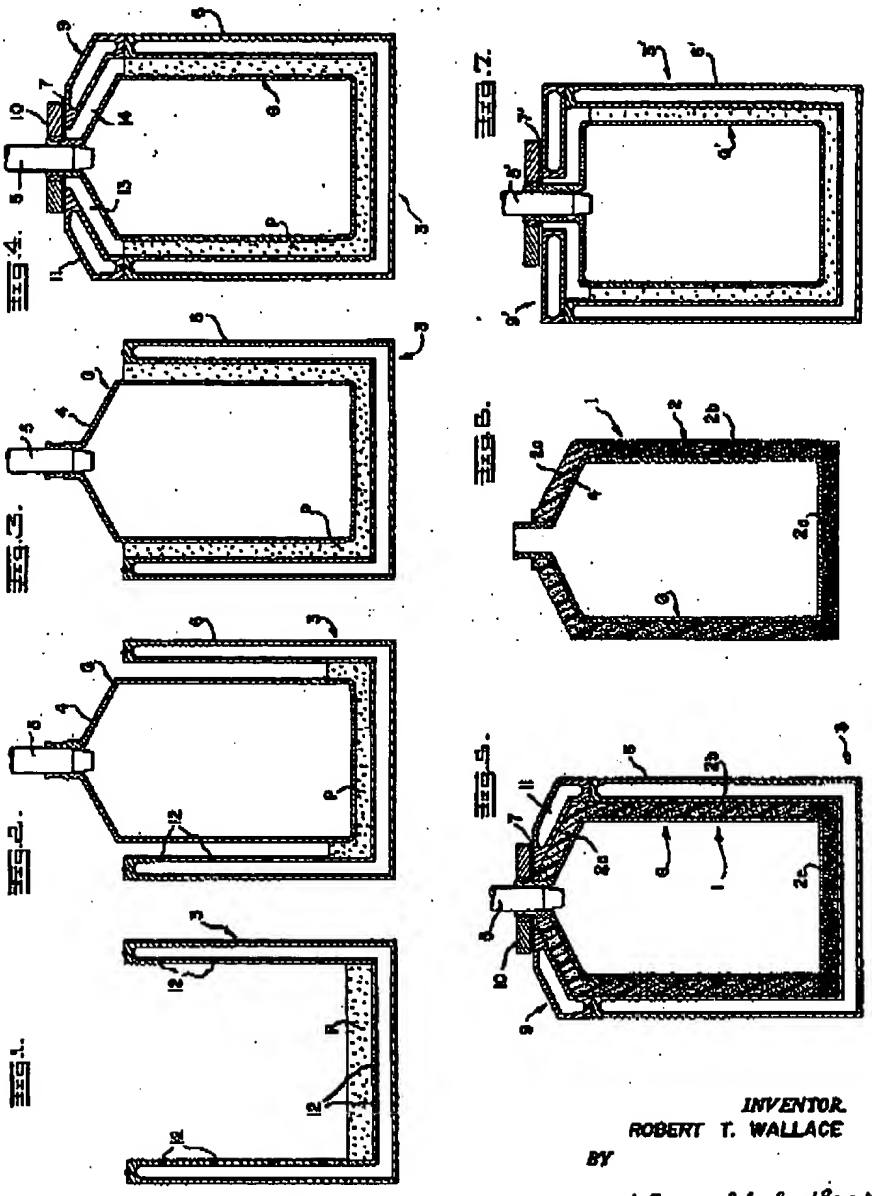

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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PLASTIC COATED ARTICLES AND METHOD FOR MAKING THE SAME

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10 Claims. (Cl. 215—1)

This invention relates generally to fragile articles and more particularly to glass containers which have improved resistance to breakage due to mechanical shock. More specifically this invention is directed to articles such as glass containers having a surface which is modified by application of a plastic coating or casing thereto for the purpose of making the articles less susceptible to cracking or breaking due to mechanical impact and to a method for making such plastic coated containers.

It has been customary in order to minimize breakage to encase large glass containers, such as carboys, in packing material all of which is placed in a cardboard or wooden box. These have been found to have a number of disadvantages including bulkiness and excessive weight. In addition with some of the large carboys of six and one-half gallons capacity and which may be used for holding drinking water, the cost of the packing has exceeded the cost of the liquid stored therein. Finally in spite of all of the packing material used plus its enclosing carton, the glass carboy has often been broken in shipping. Where the carboy contains corrosive chemicals, there is also the danger of damaging other containers nearby or injuring individuals who have to handle the carboys.

In the manufacture of protective plastic casings for fragile articles it would be desirable to form the same with walls with variable density in order that the casings will be stronger in certain areas so as to withstand the added stress and strain they have to undergo in contrast to areas which are subject to less shock which can be made less dense. This has the further advantage in that it results in a more efficient utilization of a given amount of molding material used to make the casing.

In view of the above problems associated with packing fragile containers for shipping it is an object of this invention to provide the containers which have a greater resistance to mechanical breakage.

It is another object of this invention to provide a coating for a container which is less bulky and lighter in weight than present packing containers used to encase fragile articles.

A further object of this invention is to provide a fragile container with a coating of variable density for protection against breakage whereby the density and therefore the strength of the coating will be greatest where the container is subject to the greatest mechanical impact and shock.

A further object of this invention is to provide a method for fabricating the walls of casings whose walls will be adapted to withstand variable stresses and strains.

A further object of this invention is to provide a preferred method for shaping plastic casings in which the walls are denser in those areas subject to greater stress and shock and less dense in those areas which are subject to lesser stress and shock.

A further object is to provide a method for producing cellular plastic casings in which the plastic materials which make up the casings are more efficiently utilized to provide casings of maximum strength under varying conditions of stress, strain and shock.

A further object is to provide a method for producing cellular plastic casings which are lighter and yet stronger than conventional casings presently being employed in which the plastic materials which make up the casings are more efficiently utilized to provide casings of maximum strength under varying conditions of stress, strain and shock.

It is a still further object of the present invention to provide a protective surface for a fragile article which is considerably less expensive than conventional packing cartons for the same purpose. These and other objects will be apparent from the description which follows.

The present invention comprises a novel plastic coated fragile article having a coating of cellular plastic, preferably polystyrene, of differential density. In the preferred embodiment the coating is made adherent to the fragile article. Due to the differences in density of the polystyrene coating, the strength thereof is greatest where the density reaches a maximum and least where the density reaches a minimum. The present invention also includes a method for manufacturing the aforementioned plastic coated containers and incidentally thereto discloses apparatus for effecting the same.

The present invention will be more completely understood by reference to the following drawings in which:

FIGURE 1 is a perforated mold in section partly filled with heat expansible plastic beads which are partially expanded.

FIGURE 2 shows the article or carboy to be encased as centrally positioned within the mold cavity.

FIGURE 3 shows the mold cavity incompletely filled with additional heat expansible plastic beads.

FIGURE 4 shows the mold in closed position.

FIGURE 5 shows the mold closed with heat applied causing an expansion of the beads to enclose completely the carboy.

FIGURE 6 is a sectional view of a plastic coated bottle made in accordance with this invention.

FIGURE 7 is similar to FIGURE 4 but shows a non-perforated mold of different configuration.

Referring to the drawings, the plastic coated container 1 shown in FIGURE 6, consists of a glass bottle G enveloped by a foamed plastic coating 2 of polystyrene of variable density. The most dense area is indicated as *c*, a less dense area as *b*, and the least dense area as *a*. Since area *c* is the most dense with polystyrene, it is also the strongest which is most desirable since this is the area which is subject to the most mechanical shock due largely to dropping of the plastic coated container. Area *b* which is less dense is found to be subject to the next greatest amount of mechanical shock due largely to lateral compressive forces. Finally it has been noted that area *a* is usually subject to the least mechanical shock. However, this area is the least dense and accordingly has the least strength. The net result is that for a given amount of a plastic plastic to be used as a coating, the plastic coated container of this invention provides the most efficient utilization of the plastic. It will be noted that if the container had a foamed plastic coating of uniform density, the strength thereof would be the same throughout such that certain areas which are subject to the least amount of shock would be stronger than necessary while areas which need to withstand greater impacts from mechanical forces would be of no greater density or strength, and accordingly would be more prone to breakage in those areas.

The relationship of density of foamed or cellular plastic to strength is illustrated by the following table:

TABLE I

Correlation of strength with density

Density of Cellular Polystyrene Coating	Compressive Strength, p.s.i.	Unnotched Impact Strength (Izod Test)
2 lb. per cu. ft.	18	2 in. lbs. per in.
4 lb. per cu. ft.	36	2.8 in. lbs. per in.
6 lb. per cu. ft.	56	3.5 in. lbs. per in.

It will be apparent from the foregoing table that if in FIGURE 6 the cellular polystyrene plastic has a 2 lb. per cu. ft. density in area *a*, a 4 lb. per cu. ft. density in area *b*, and a 6 lb. per cu. ft. density in area *c*, the surface of the plastic coated article will exhibit varying degrees of strength.

Although the density of plastic coating may vary from 2 to 6 lbs. per cu. ft., higher and lower ranges of densities may be employed depending upon how fragile the article being enclosed is. In certain applications densities ranging from 1 lb. per cu. ft. to a maximum of 3 lb. per cu. ft. may satisfactorily be employed.

It has also been noted that protective plastic lining is more effective if an adhesive 4 is applied between the plastic 2 and container 1 as shown in FIGURE 6.

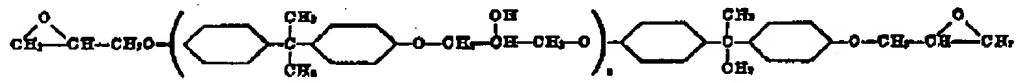
The foam encased glass articles of the present invention have been found extremely resistant to breakage in spite of their light weight. For example, a 6½ gallon carboy encased in a conventional packing and wood enclosed box weighs 36½ lbs. and will not survive a drop test of 85 inches. On the other hand a foam encased 6½ gallon carboy of this invention weighs only 18½ lbs. and does not break from the maximum testing distance used, namely, 90 inches. The test referred to is the standard I.C.C. swing test which consists of placing the carboy filled with water in a swing cradle and then swinging the cradle in pendulum fashion against an impact block for distances from 55" to 90". Whether the impact was directed against the side or bottom of the encased carboy, no breakage of the bottle occurred although in some tests involving side impacting the casing exhibited some cracking. However, this cracking did not occur where an adhesive was employed between the carboy and outer plastic casing.

The method and apparatus for making the plastic coated articles of this invention may best be understood by reference to FIGURES 1 through 5 inclusive. More specifically the steps in molding the plastic coated articles of this invention include first partly filling mold 3, which has hollow walls 6 with perforations 12 on its inner surface, with heat expansible plastic beads P which are partially expanded as shown in FIGURE 1 and thereafter centrally positioning by means of support 5 within the mold cavity the article or carboy G to be encased as indicated by FIGURE 2. With the carboy in position the mold is incompletely filled with additional heat expansible plastic beads as illustrated by FIGURE 3. Mold 3 is then closed by upper mold member 9, which is not perforated, and sealing plate 10 as shown by FIGURE 4. Superheated dry steam at 220–280° F. and 10–30 p.s.i. is introduced into the hollow mold walls 6 and 11 as shown by FIGURE 5 from a source of steam (not shown). The molding cycle takes from 15 to 60 seconds with perforated mold members depending upon the temperature of the steam and the material from which the mold is made. Of course where non-perforated mold members are employed the heating cycle will be longer. The same will be true where iron molds are used instead of aluminum molds. The introduction of the steam results not only in expanding the beads further so as to fill the mold cavity in areas 13 and 14 (compare FIGURES 4 and 5), but also causes the beads to fuse and coalesce in such a manner that the area around the neck of the container is least dense. The most dense area, and therefore the strongest, is the plastic which lies along the bottom and is indicated by *c*. Part of this increased density is due to the entrapment of the bead particles (see FIGURE 2) which does not permit the bead particles located in this area to expand freely and therefore to become less dense. So as to ensure a free flow of gas generated in the mold cavity, bleed passages 7 for the gas to escape are provided. In the preferred mode of operation an adhesive 4 is first applied to the container before insertion of the carboy G into the mold (see FIGURE 2). As mentioned above it has been noted that the protective plastic coating is still more resistant to breakage if an adhesive 4 is applied between the plastic 2 and container 1 as shown in FIGURE 6. After completion of the molding cycle the mold is allowed to cool, usually from 1 to 6 minutes, and the encased carboy thereafter removed. This cooling step may be accelerated by passing water through the hollow walls 6 of the mold after the steam heating step has been completed.

FIGURE 7 is similar to FIGURE 4 except that the article is of a different shape and corresponding parts are indicated by letter and number with a prime (') thereafter. It will be noted in FIGURE 7 that neither the upper nor lower mold member has perforated walls to permit the steam to come into direct contact with the plastic beads for purposes of effecting an expansion and coalescence thereof. The apparatus of FIGURE 7 may be said to be illustrative of indirect steam heating of the plastic beads in contrast to the apparatus of FIGURES 1–5 which is illustrative of direct steam heating of the plastic beads.

Various adhesives either of the (1) drying type or (2) thermosetting type may be used. Representative of the drying type are Marbon 11670, a resin or rubber emulsion, made by the Marbon Corporation, Gary, Ind., or Styrogrip 145–0, a resin or rubber solvent, made by the Hughes Glue Company, Detroit, Mich. Typical of the thermosetting type are Hysol 2020 made by Houghton Laboratories, Olean, N.Y., and Epon VI made by the Shell Chemical Corporation, New York City, which are both of the cold setting epoxy type.

As a specific example of a suitable adhesive there can be mentioned, for instance, a liquid epoxy resin known as Epon 828 having an epoxide equivalent of 175–210 and a Gardner-Holdt viscosity at 25° C. of 50–150 poises, and prepared by the reaction of Bisphenol-A with epichlorohydrin to obtain condensation polymers having a basic structure believed to be as follows:



This resin is cured by mixture with about six parts of diethylaminopropylamine per 100 parts of resin. This mixture is coated on the container to which the plastic covering is to be bonded.

A plastic suitable for encasing the containers includes a polystyrene such as Dylite which is in the form of beads and manufactured by the Koppers Company, Inc., Pittsburgh, Pa. These polystyrene beads contain a volatile liquid, n-pentane, as an expanding agent. Particulate polystyrene containing any volatile liquid expanding agent can be employed. These beads can be given a pre-expansion treatment which consists of heating the original or virgin beads from 180–240° F. until densities ranging from 1 to 5 lbs. per cubic foot are obtained depending upon the density desired. However, any plastic can be

used which is capable of being formed and further expanded upon the application of additional heat in the manner described above.

It is understood that the invention described above is a preferred embodiment particularly as exemplified by the direct steam heating method and apparatus; and that certain variations can be made without limiting the scope of the invention herein disclosed. By way of example the mold cavity may have other shapes than that shown and the upper mold member 9 may also be perforated. Moreover, the steam heating means may be placed by other heating means such as by resistance or inductance electrical heating, if found desirable. In addition other fluids than steam capable of being heated to high temperatures without decomposition may be employed. To facilitate removal of the encased carboy the mold members 3 and 9 may be coated with any of the well-known mold release agents or lubricants such as the silicones. Finally the carboy may be preheated prior to placement in the mold so as to avoid any breakage due to thermal shock during the heating of the plastic beads. Other appropriate changes may be made within the skill of one familiar with the art without circumscribing or limiting the invention set forth herein, and the invention may take other forms as a result of these changes and yet come within the scope of the appended claims.

Although glass has been shown as the preferred composition of the article being encased by the plastic, it is to be understood that the article to be encased may be made of wood or plastic.

From the foregoing description it will be apparent that the applicant has devised a plastic coated article, including a method and apparatus for making the same, which is light in weight, resistant to mechanical impact, and relatively inexpensive to make.

Having thus described the invention it will be evident to those skilled in the art that various modifications may be made which would not depart from the spirit of the present invention as defined in the following claims.

What I claim is:

1. A container of increased resistance to mechanical breakage comprising an inner fragile portion having an area subject, in the normal handling of said container, to a greater external mechanical shock than another area of said inner fragile portion, and an outer plastic covering characterized by having a cellular structure and areas of lesser and greater density wherein the area of greater density is adjacent to that area of the inner fragile portion which is subject to a greater external mechanical shock and the area of lesser density is adjacent to that area of the inner fragile portion which is subject to a lesser external mechanical shock.

2. The container of claim 1 in which the inner fragile portion is glass.

3. The container of claim 1 in which the inner fragile portion is wood.

4. The container of claim 1 in which the outer plastic covering is polystyrene.

5. The container of claim 1 in which the outer plastic covering is of substantially uniform thickness.

6. A container of increased resistance to mechanical breakage comprising an inner fragile portion having an area subject, in the normal handling of said container, to a greater external mechanical shock than another area of said inner fragile portion, an outer plastic covering characterized by having a cellular structure and areas of lesser and greater density wherein the area of greater density is adjacent to that area of the inner fragile portion which is subject to a greater external mechanical shock and the area of lesser density is adjacent to that area of the inner fragile portion which is subject to a lesser external mechanical shock, and an adhesive layer joining said inner portion with said outer covering.

7. The container of claim 6 in which the inner fragile portion is wood.

8. The container of claim 6 in which the inner fragile portion is glass.

9. The container of claim 6 in which the outer plastic covering is polystyrene.

10. The container of claim 6 in which the outer plastic covering is of substantially uniform thickness.

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